FCC Test Report

Report No.:	FC170713D01
FCC ID:	2ALJ3AP24X
Test Model:	AP241, AP241e
Received Date:	Jul. 13, 2017
Test Date:	Aug. 18 ~ Sep. 21, 2017
Issued Date:	Dec. 13, 2017
Applicant:	HAN Networks Co., Ltd.
Address:	5/F, Building 37, No.8 Dongbeiwang West Road, HaiDian District, Beijing, China
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C.)
FCC Registration/ Designation Number:	418586 / TW1078

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Certificate #4327.01

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TAF
Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
FC170713D01	Original release.	Dec. 13, 2017

1 Certificate of Conformity

Product:	HAN Access Point
Brand:	HAN
Test Model:	AP241, AP241e
Sample Status:	Engineering sample
Applicant:	HAN Networks Co., Ltd.
Test Date:	Aug. 18 ~ Sep. 21, 2017
Standards:	47 CFR FCC Part 15, Subpart B, Class B ICES-003:2016 Issue 6, Class B ANSI C63.4:2014

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Jessica Cheng , **Date:** Dec. 13, 2017

Jessica Cheng / Senior Specialist

Approved by : Henry Lai , **Date:** Dec. 13, 2017

Henry Lai / Director

2 Summary of Test Results

47 CFR FCC Part 15, Subpart B / ICES-003:2016 Issue 6, Class B

ANSI C63.4:2014

FCC Clause	ICES-003 Clause	Test Item	Result/Remarks	Verdict
15.107	6.1	AC Power Line Conducted Emissions	Minimum passing Class B margin is -14.53 dB at 24.92578 MHz	Pass
15.109	6.2.1	Radiated Emissions up to 1 GHz	Minimum passing Class B margin is -3.04 dB at 960.05 MHz	Pass
	6.2.2	Radiated Emissions above 1 GHz	Minimum passing Class B margin is -7.39 dB at 1440.21 MHz	Pass

Note: There is no deviation to the applied test methods and requirements covered by the scope of this report.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.77 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.99 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.12 dB
	6GHz ~ 18GHz	5.09 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 Features of EUT

The tests reported herein were performed according to the method specified by HAN Networks Co., Ltd., for detailed feature description, please refer to the manufacturer's specifications or user's manual.

3.2 General Description of EUT

Product	HAN Access Point
Brand	HAN
Test Model	AP241, AP241e
Model Difference	Refer to note as below
Sample Status	Engineering sample
Operating Software	N/A
Power Supply Rating	48Vdc from Adapter or 55Vdc from PoE
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. All models are listed as below.

Brand	Model	Difference
HAN	AP241	Internal PIFA antenna for Bluetooth function, and internal PIFA antenna for WLAN function
	AP241e	Internal PIFA antenna for Bluetooth function, and external Dipole antenna for WLAN function

2. The EUT uses following Adapter or PoE (support unit for test).

Item	Brand	Model No.	Specification
Adapter	LI TONE ELECTRONICS CO., LTD.	LTE36ES-S5-1	AC I/P: 100-240V, 50/60Hz, 0.75A DC O/P: 48V, 0.75A Non-shielded AC cable (1.8m) AC 3- Pin Non-shielded DC cable (1.8m)
PoE	Microsemi	PD-9001GR/AC	AC I/P: 100-240V, 50.60Hz, 0.67A DC O/P: 55V, 0.6A

3.3 Operating Modes of EUT and Determination of Worst Case Operating Mode

1. The EUT has been pre-tested under following test modes, and **Pre-test mode 5** was the worst case.

Test Condition							
Pre-tested mode		**1**	**2**	**3**	**4**	**5**	**6**
Test Model	AP241e	V	V	V	V	V	
	AP241						V
Power Supply	Adapter	V	V	V	V		
	PoE					V	V
LAN 2 Speed	2.5Gbps	V	V			V	V
	1G bps			V			
	100Mbps				V		
LAN 1 Speed	1G bps	V	V			V	V
	100Mbps			V			
	10Mbps				V		
The position of EUT	Horizontal	V		V	V	V	V
	Vertical		V				

2. Test modes are presented in the report as below.

Mode		Test Condition	Input Power
Conducted emission test			
1	A	Model: AP241e, Adapter Mode, Horizontal, WLAN 5G & 2.4G Link + BT Idle, LAN 1 Speed 1Gbps + LAN 2 Speed 2.5Gbps	120Vac, 60Hz
	B	Model: AP241, Adapter Mode, Horizontal, WLAN 5G & 2.4G Link + BT Idle, LAN 1 Speed 1Gbps + LAN 2 Speed 2.5Gbps	
5		Model: AP241e, PoE Mode, Horizontal, WLAN 5G & 2.4G Link + BT Idle, LAN 1 Speed 1Gbps + LAN 2 Speed 2.5Gbps	PoE (55Vdc)
6		Model: AP241, PoE Mode, Horizontal, WLAN 5G & 2.4G Link + BT Idle, LAN 1 Speed 1Gbps + LAN 2 Speed 2.5Gbps	
Radiated emission test			
5		Model: AP241e, PoE Mode, Horizontal, WLAN 5G & 2.4G Link + BT Idle, LAN 1 Speed 1Gbps + LAN 2 Speed 2.5Gbps	PoE (55Vdc)

Note: Define mode as below:
1= Pre-tested mode 1,
5= Pre-tested mode 5,
6= Pre-tested mode 6,
A= Model: AP241e,
B= Model: AP241

3.4 Test Program Used and Operation Descriptions

a. Turned on the power of all equipment.
b. Prepared notebooks & PC & Cell phone to act as communication partners and placed them outside of testing area.
c. The communication partner sent data to EUT by command “Ping” via WLAN.
d. The communication partner sent data to EUT by command “TfGen” + “Ping” via LAN.
e. Set BT function of EUT on idle condition.
f. The notebooks read and wrote messages from USB Flash via EUT.
g. Steps c-f were repeated.

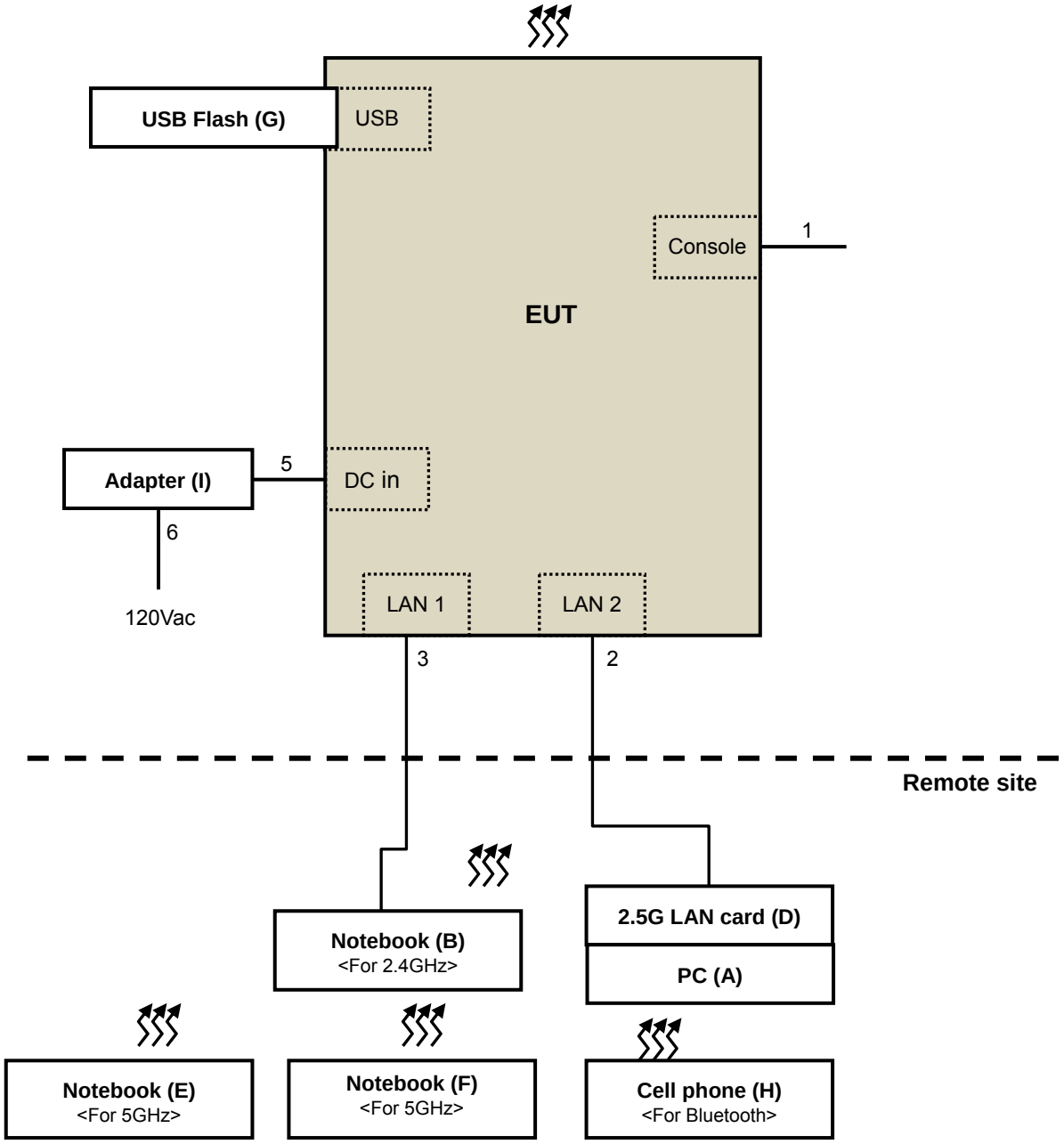
3.5 Primary Clock Frequencies of Internal Source

The highest frequency generated or used within the EUT or on which the EUT operates or tunes is 6GHz, provided by HAN Networks Co., Ltd., for detailed internal source, please refer to the manufacturer's specifications.

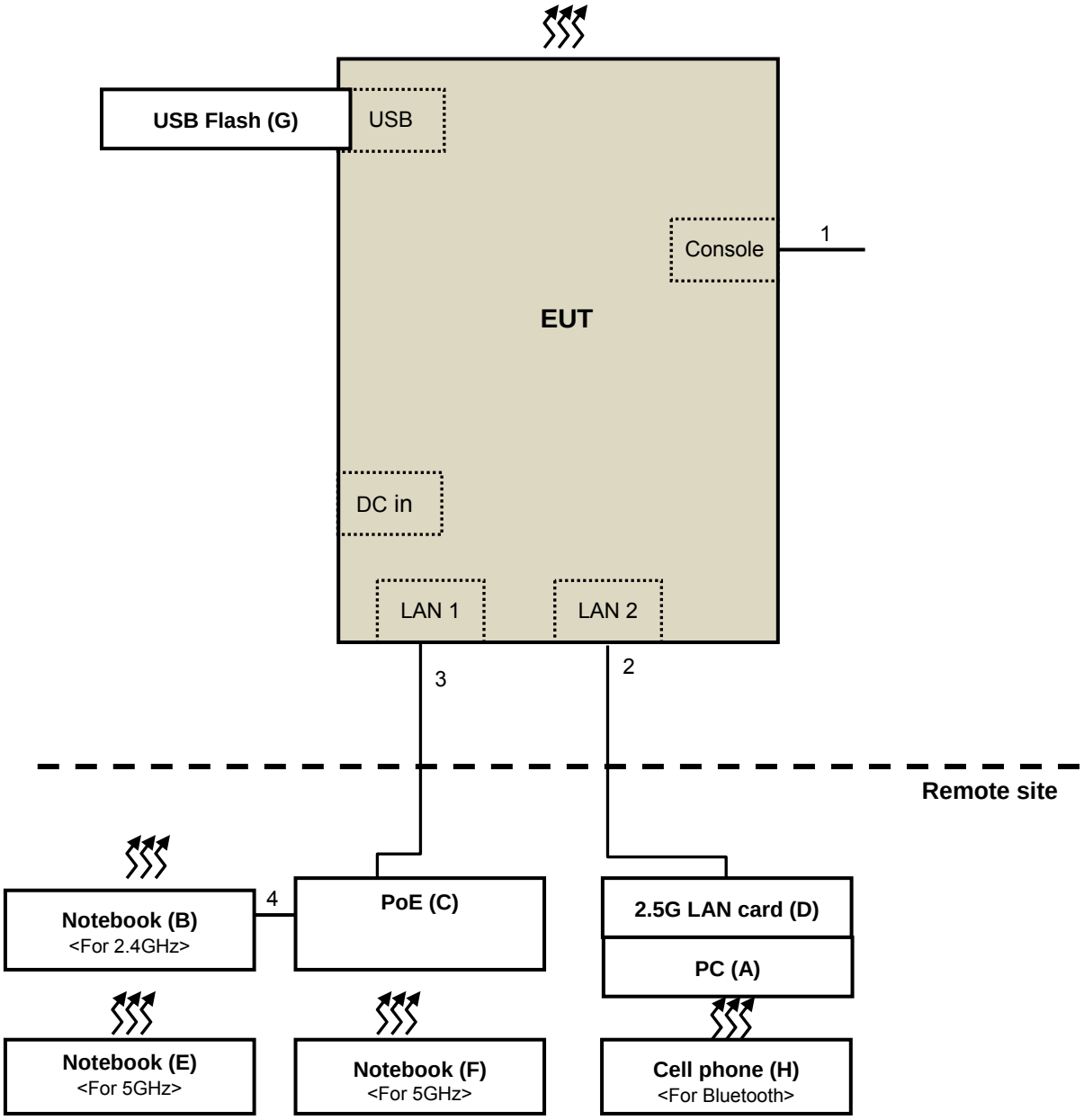
4 Configuration and Connections with EUT

4.1 Connection Diagram of EUT and Peripheral Devices

Mode 1:



Mode 5 & 6:


USB Flash (G)
USB
Console
1
EUT
DC in
LAN 1
LAN 2
3
2
Remote site
Notebook (B)
<For 2.4GHz>
4
PoE (C)
2.5G LAN card (D)
PC (A)
Notebook (E)
<For 5GHz>
Notebook (F)
<For 5GHz>
Cell phone (H)
<For Bluetooth>

4.2 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	PERSONAL COMPUTER	LENOVO	3212-A15	PB5TNMK	FCC DoC Approved	Provided by Lab
B.	Notebook PC	DELL	P41G	HT4W952	FCC DoC Approved	Provided by Lab
C.	PoE	Microsemi	PD-9001GR/AC	C164762300000006456	N/A	Supplied by client
D.	2.5G LAN card	ASUS	XG-C100C	H4QSRT000342	N/A	Provided by Lab
E.	Notebook PC	ASUS	PU401L	ECNXBC012528528	FCC DoC Approved	Provided by Lab
F.	Notebook PC	SONY	SVS151A12P	275548477001024	FCC DoC Approved	Provided by Lab
G.	USB 3.0 Flash Drive	Transcend	Usb3.0 8G	N/A	N/A	Provided by Lab
H.	Cell Phone	HTC	PJ46100	HT261W101910	NM8PJ46100	Provided by Lab
I.	Adapter	LI TONE ELECTRONICS CO., LTD.	LTE36ES-S5-1	N/A	N/A	Supplied by client

Note:
1. All power cords of the above support units are non-shielded (1.8m).
2. Items A-F, H acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	LAN to RS232 cable	1	1.8	N	0	Provided by Lab
2.	LAN cable	1	10	N	0	Provided by Lab
3.	LAN cable	1	10	N	0	Provided by Lab
4.	LAN cable	1	1.5	N	0	Provided by Lab
5.	DC cable	1	1.8	N	0	Supplied by client
6.	AC cable	1	1.8	N	0	Supplied by client

Note: The core(s) is(are) originally attached to the cable(s).

5 Conducted Emissions at Mains Ports

5.1 Limits

Frequency (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

Notes: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

5.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100290	Dec. 26, 2016	Dec. 25, 2017
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH2-Z5	100104	Dec. 1, 2016	Nov. 30, 2017
LISN With Adapter (for EUT)	AD10	C09Ada-001	Dec. 1, 2016	Nov. 30, 2017
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	847265/023	Oct. 27, 2016	Oct. 26, 2017
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 9, 2017	May 8, 2018
Software	Cond_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C09.01	Feb. 21, 2017	Feb. 20, 2018
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010789	May 18, 2017	May 17, 2018
ROHDE & SCHWARZ Artificial Mains Network (For TV EUT)	ESH3-Z5	100220	Nov. 8, 2016	Nov. 7, 2017
LISN With Adapter (for TV EUT)	100220	N/A	Nov. 8, 2016	Nov. 7, 2017

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. 9.
3. The VCCI Site Registration No. C-1312.
4. The FCC Designation Number is TW1078.
5. Tested Date: Sep. 21, 2017

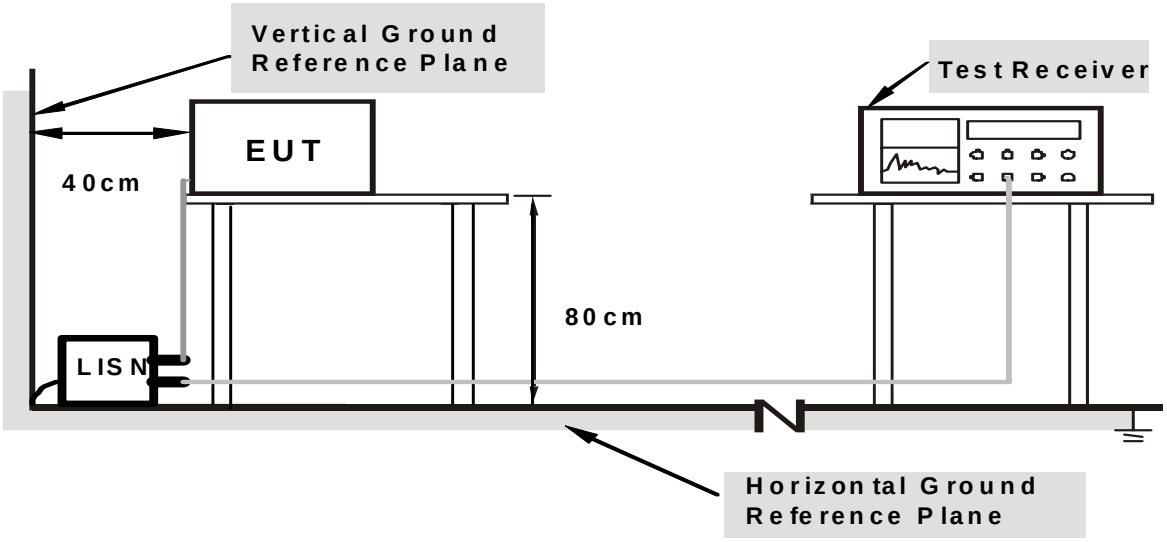
5.3 Test Arrangement

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.



Note: Support units were connected to second LISN.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

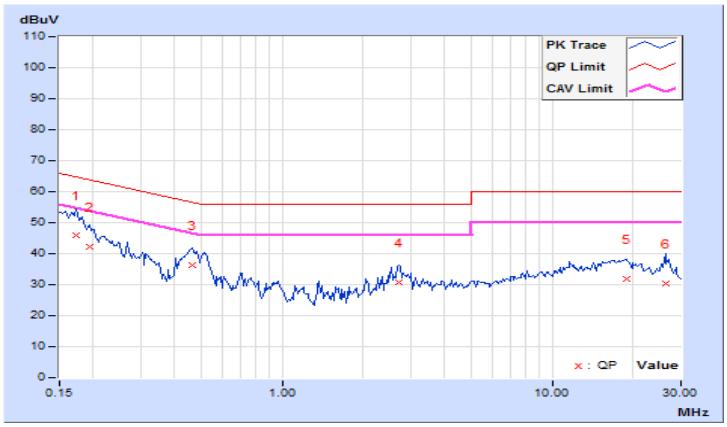
5.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	26℃, 74%RH
Tested by	Vincent Chen		
Test Mode	Mode 1A		

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17344	10.09	35.99	20.43	46.08	30.52	64.79	54.79	-18.71	-24.27
2	0.19297	10.11	32.10	13.80	42.21	23.91	63.91	53.91	-21.70	-30.00
3	0.46641	10.20	25.94	20.46	36.14	30.66	56.58	46.58	-20.44	-15.92
4	2.71094	10.45	20.39	11.65	30.84	22.10	56.00	46.00	-25.16	-23.90
5	18.78125	11.04	20.71	16.05	31.75	27.09	60.00	50.00	-28.25	-22.91
6	26.23438	11.12	19.15	14.32	30.27	25.44	60.00	50.00	-29.73	-24.56

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

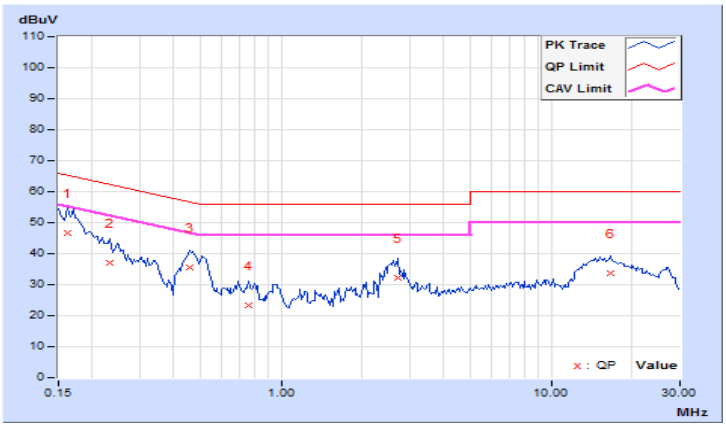


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	**Environmental Conditions**	26℃, 74%RH
Tested by	Vincent Chen		
Test Mode	Mode 1A		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.16172	10.09	36.76	19.17	46.85	29.26	65.38	55.38	-18.53	-26.12
2	0.23203	10.06	26.91	10.64	36.97	20.70	62.38	52.38	-25.41	-31.68
3	0.45859	10.18	25.23	20.46	35.41	30.64	56.72	46.72	-21.31	-16.08
4	0.75938	10.27	13.10	10.28	23.37	20.55	56.00	46.00	-32.63	-25.45
5	2.69922	10.37	21.69	12.72	32.06	23.09	56.00	46.00	-23.94	-22.91
6	16.57422	10.76	23.10	18.63	33.86	29.39	60.00	50.00	-26.14	-20.61

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

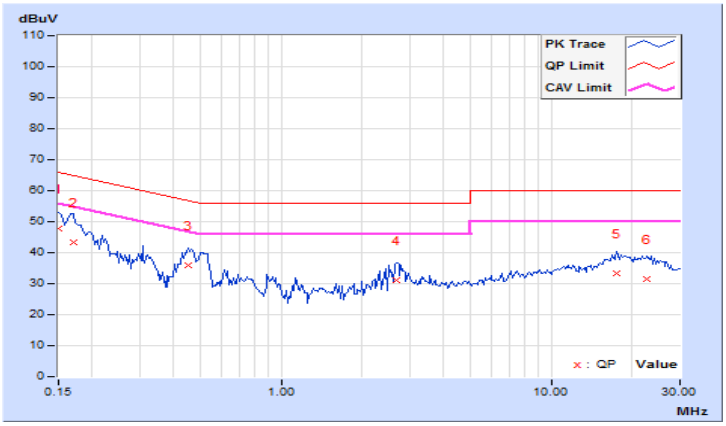


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	**Environmental Conditions**	26℃, 74%RH
Tested by	Vincent Chen		
Test Mode	Mode 1B		

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15000	10.08	37.75	20.32	47.83	30.40	66.00	56.00	-18.17	-25.60
2	0.16953	10.09	33.21	13.26	43.30	23.35	64.98	54.98	-21.68	-31.63
3	0.45469	10.20	25.73	19.25	35.93	29.45	56.79	46.79	-20.86	-17.34
4	2.67969	10.45	20.48	11.78	30.93	22.23	56.00	46.00	-25.07	-23.77
5	17.44922	10.98	22.22	17.47	33.20	28.45	60.00	50.00	-26.80	-21.55
6	22.74219	11.11	20.38	15.19	31.49	26.30	60.00	50.00	-28.51	-23.70

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

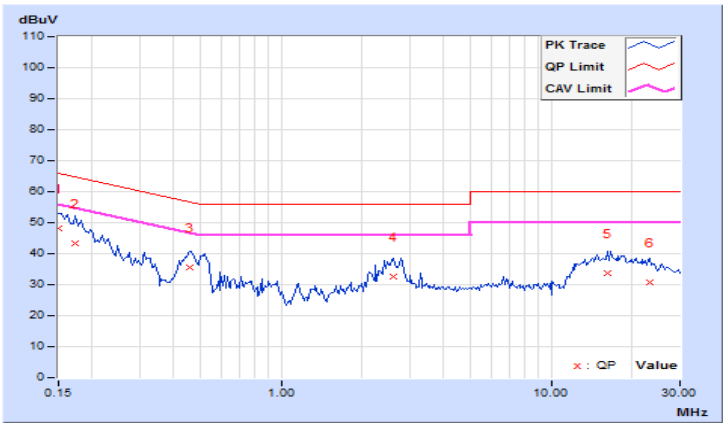


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	**Environmental Conditions**	26℃, 74%RH
Tested by	Vincent Chen		
Test Mode	Mode 1B		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15000	10.10	38.10	18.89	48.20	28.99	66.00	56.00	-17.80	-27.01
2	0.17344	10.07	33.33	15.35	43.40	25.42	64.79	54.79	-21.39	-29.37
3	0.45859	10.18	25.23	18.80	35.41	28.98	56.72	46.72	-21.31	-17.74
4	2.60547	10.36	22.35	11.56	32.71	21.92	56.00	46.00	-23.29	-24.08
5	16.12109	10.75	22.96	18.52	33.71	29.27	60.00	50.00	-26.29	-20.73
6	23.23047	10.71	20.00	14.69	30.71	25.40	60.00	50.00	-29.29	-24.60

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

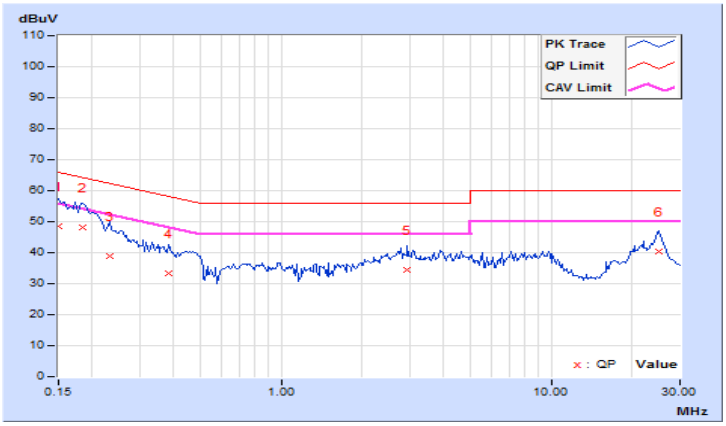


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	55Vdc	**Environmental Conditions**	26℃, 74%RH
Tested by	Vincent Chen		
Test Mode	Mode 5		

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15000	10.08	38.58	11.67	48.66	21.75	66.00	56.00	-17.34	-34.25
2	0.18516	10.10	38.01	16.99	48.11	27.09	64.25	54.25	-16.14	-27.16
3	0.23203	10.12	28.87	2.82	38.99	12.94	62.38	52.38	-23.39	-39.44
4	0.38438	10.18	23.23	8.44	33.41	18.62	58.18	48.18	-24.77	-29.56
5	2.92578	10.47	23.98	15.21	34.45	25.68	56.00	46.00	-21.55	-20.32
6	**24.92578**	**11.12**	**29.37**	**24.35**	**40.49**	**35.47**	**60.00**	**50.00**	**-19.51**	**-14.53**

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

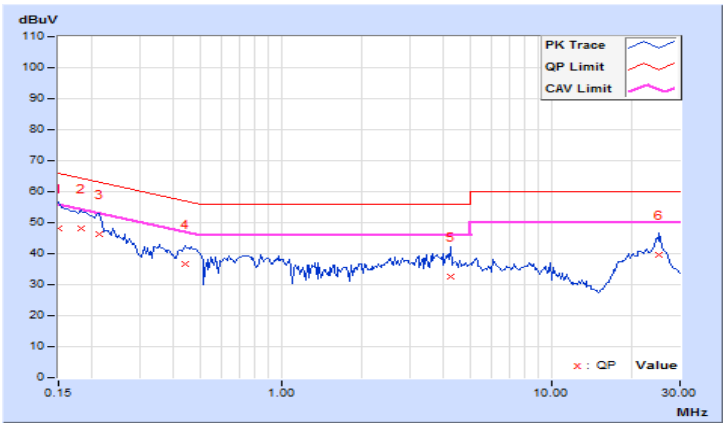


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	55Vdc	**Environmental Conditions**	26℃, 74%RH
Tested by	Vincent Chen		
Test Mode	Mode 5		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15000	10.10	37.97	10.68	48.07	20.78	66.00	56.00	-17.93	-35.22
2	0.18125	10.06	38.21	16.28	48.27	26.34	64.43	54.43	-16.16	-28.09
3	0.21250	10.05	36.21	18.84	46.26	28.89	63.11	53.11	-16.85	-24.22
4	0.44297	10.17	26.66	10.47	36.83	20.64	57.01	47.01	-20.18	-26.37
5	4.25781	10.50	22.19	12.46	32.69	22.96	56.00	46.00	-23.31	-23.04
6	25.12109	10.64	29.07	24.03	39.71	34.67	60.00	50.00	-20.29	-15.33

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

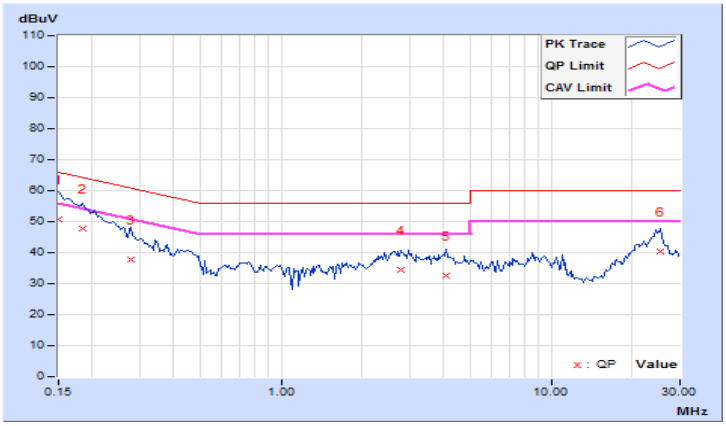


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	55Vdc	**Environmental Conditions**	26℃, 74%RH
Tested by	Vincent Chen		
Test Mode	Mode 6		

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15000	10.08	40.77	12.26	50.85	22.34	66.00	56.00	-15.15	-33.66
2	0.18516	10.10	37.85	16.89	47.95	26.99	64.25	54.25	-16.30	-27.26
3	0.27891	10.14	27.54	11.11	37.68	21.25	60.85	50.85	-23.17	-29.60
4	2.76563	10.46	23.99	15.10	34.45	25.56	56.00	46.00	-21.55	-20.44
5	4.10938	10.56	21.95	13.36	32.51	23.92	56.00	46.00	-23.49	-22.08
6	25.38281	11.12	29.11	24.01	40.23	35.13	60.00	50.00	-19.77	-14.87

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

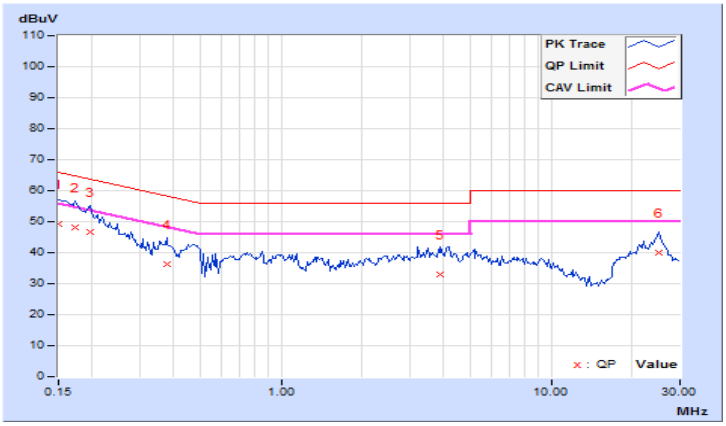


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	55Vdc	**Environmental Conditions**	26℃, 74%RH
Tested by	Vincent Chen		
Test Mode	Mode 6		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15000	10.10	39.10	13.36	49.20	23.46	66.00	56.00	-16.80	-32.54
2	0.17344	10.07	37.96	11.66	48.03	21.73	64.79	54.79	-16.76	-33.06
3	0.19687	10.04	36.45	17.65	46.49	27.69	63.74	53.74	-17.25	-26.05
4	0.37656	10.15	26.01	10.57	36.16	20.72	58.35	48.35	-22.19	-27.63
5	3.90234	10.48	22.63	12.71	33.11	23.19	56.00	46.00	-22.89	-22.81
6	24.97656	10.65	29.26	24.12	39.91	34.77	60.00	50.00	-20.09	-15.23

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



6 Radiated Emissions up to 1 GHz

6.1 Limits

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dBμV/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	39	29.5	40	30
88-216	43.5	33.1		
216-230	46.4	35.6		
230-960			47	37
960-1000	49.5	43.5		

Radiated Emissions Limits at 3 meters (dBμV/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	49.5	40	50.5	40.5
88-216	54	43.5		
216-230	56.9	46		
230-960			57.5	47.5
960-1000	60	54		

Notes: 1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. QP detector shall be applied if not specified.

6.2 Test Instruments

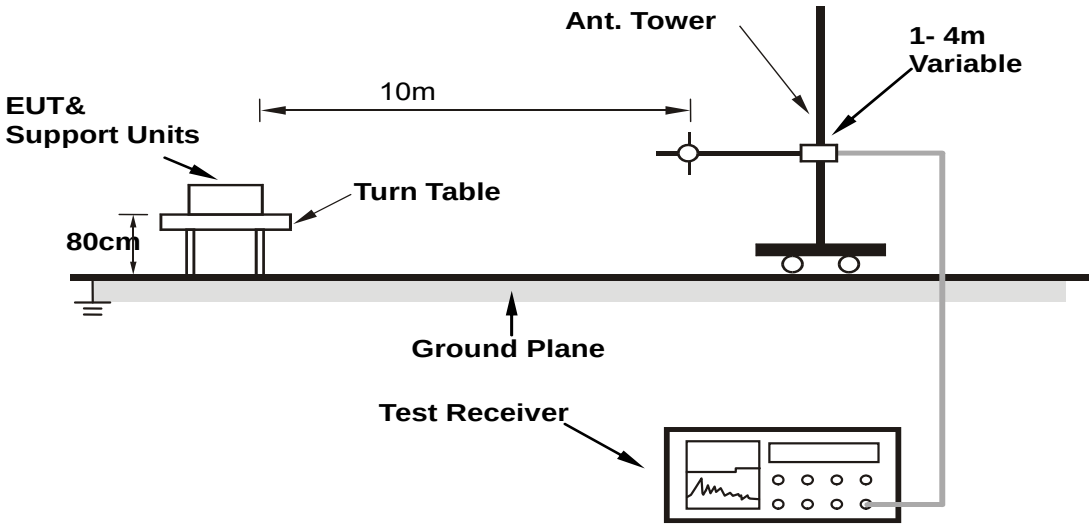
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100292	Dec. 9, 2016	Dec. 8, 2017
Schaffner Bilog Antenna	CBL6111D	22262	Dec. 28, 2016	Dec. 27, 2017
Agilent Preamplifier	8447D	2944A08119	Feb. 21, 2017	Feb. 20, 2018
ADT. Turn Table	TT100	0205	NA	NA
ADT. Tower	AT100	0205	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
ADT RF Switches BOX	EMH-011	1001	Oct. 28, 2016	Oct. 27, 2017
Pacific RF cable With 5dB PAD	8D	CABLE-ST2-01	Oct. 28, 2016	Oct. 27, 2017

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Open Site No. 2.
3. The VCCI Site Registration No. R-237.
4. The FCC Designation Number is TW1078.
5. Tested Date:Aug. 18, 2017

6.3 Test Arrangement

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited test facility. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is up to 1 GHz.

Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for quasi-peak detection (QP) at frequency up to 1GHz.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

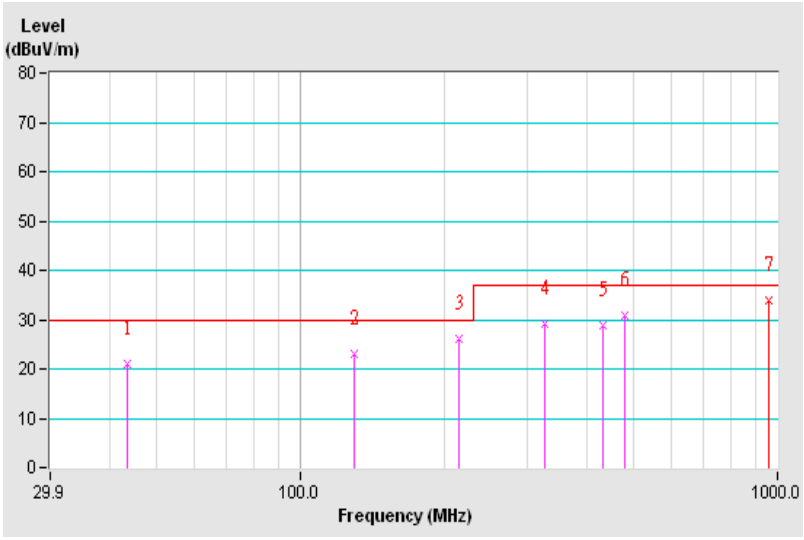
6.4 Test Results

Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	55Vdc	Environmental Conditions	33℃, 60%RH
Tested by	Vincent Lin		
Test Mode	Mode 5		

Antenna Polarity & Test Distance : Horizontal at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	43.27	21.11 QP	30.00	-8.89	4.00 H	150	33.92	-12.81
2	129.27	23.04 QP	30.00	-6.96	4.00 H	130	34.79	-11.75
3	214.31	25.96 QP	30.00	-4.04	4.00 H	252	39.47	-13.51
4	324.21	29.29 QP	37.00	-7.71	4.00 H	2	37.35	-8.06
5	431.50	28.84 QP	37.00	-8.16	3.32 H	344	34.00	-5.16
6	480.00	30.91 QP	37.00	-6.09	4.00 H	139	35.40	-4.49
7	**960.05**	**33.96 QP**	**37.00**	**-3.04**	**1.00 H**	**79**	**28.59**	**5.37**

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

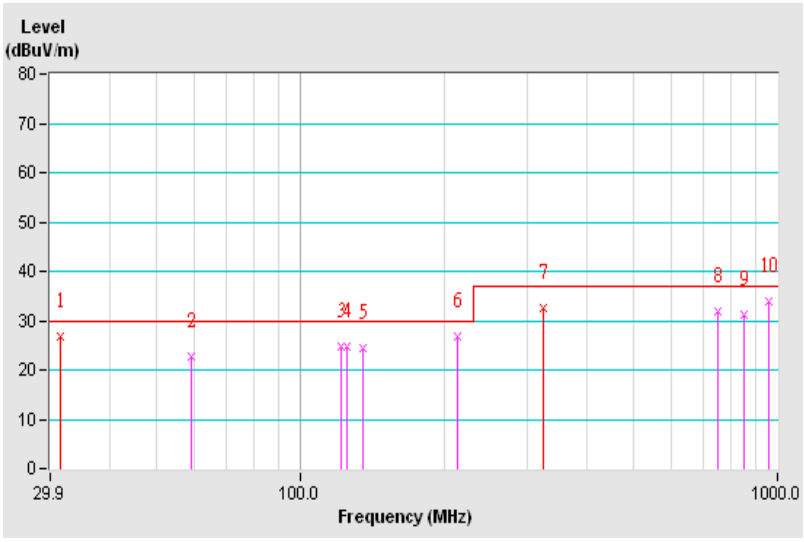


Frequency Range	30MHz ~ 1GHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP), 120kHz
Input Power	55Vdc	**Environmental Conditions**	33℃, 60%RH
Tested by	Vincent Lin		
Test Mode	Mode 5		

Antenna Polarity & Test Distance : Vertical at 10 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	31.45	26.91 QP	30.00	-3.09	1.00 V	28	33.00	-6.09
2	59.13	22.84 QP	30.00	-7.16	1.00 V	251	40.85	-18.01
3	121.97	24.85 QP	30.00	-5.15	1.00 V	258	36.69	-11.84
4	125.00	24.68 QP	30.00	-5.32	1.00 V	2	36.43	-11.75
5	135.62	24.47 QP	30.00	-5.53	1.00 V	192	36.16	-11.69
6	213.95	26.87 QP	30.00	-3.13	1.00 V	181	40.41	-13.54
7	324.01	32.66 QP	37.00	-4.34	1.00 V	194	40.73	-8.07
8	750.01	31.84 QP	37.00	-5.16	2.18 V	22	30.26	1.58
9	850.01	31.20 QP	37.00	-5.80	2.54 V	117	28.09	3.11
10	960.04	33.91 QP	37.00	-3.09	2.05 V	122	28.54	5.37

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



7 Radiated Emissions above 1 GHz

7.1 Limits

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dBμV/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
1000-3000	Avg: 49.5 Peak: 69.5	Avg: 43.5 Peak: 63.5	Not defined	Not defined
Above 3000			Not defined	Not defined

Radiated Emissions Limits at 3 meters (dBμV/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
1000-3000	Avg: 60 Peak: 80	Avg: 54 Peak: 74	Avg: 56 Peak: 76	Avg: 50 Peak: 70
Above 3000			Avg: 60 Peak: 80	Avg: 54 Peak: 74

Notes: 1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Frequency Range (For unintentional radiators)

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40GHz, whichever is lower

7.2 Test Instruments

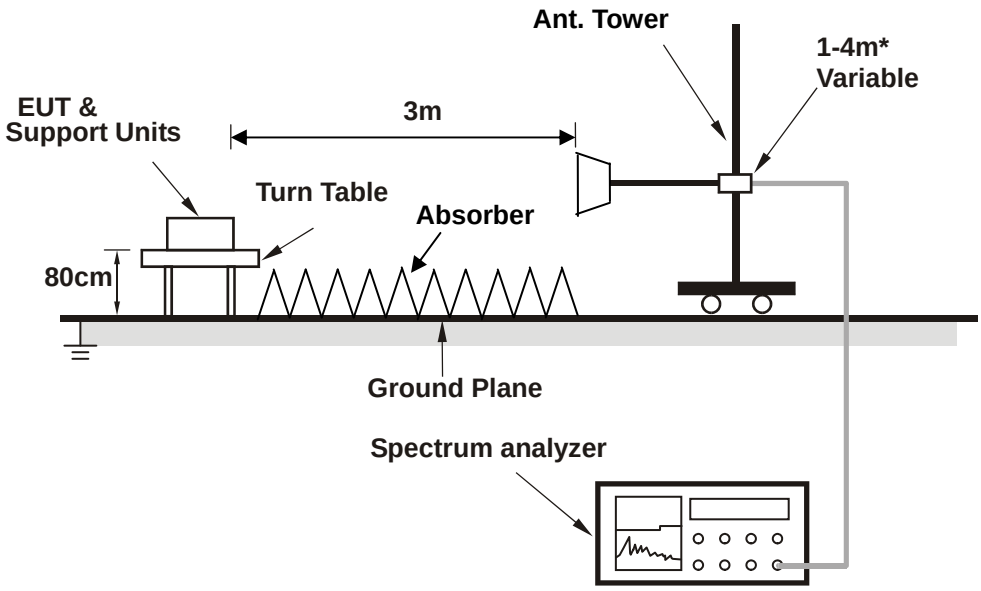
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Agilent Spectrum	E4446A	MY51100009	Jun. 1, 2017	May 31, 2018
Agilent Test Receiver	N9038A	MY50010135	Jun. 29, 2017	Jun. 28, 2018
Agilent Preamplifier	8449B	3008A02367	Feb. 22, 2017	Feb. 21, 2018
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2017	Feb. 20, 2018
EMCI Preamplifier	EMC184045B	980235	Feb. 22, 2017	Feb. 21, 2018
Schwarzbeck Horn Antenna	BBHA-9170	212	Dec. 30, 2016	Dec. 29, 2017
EMCO Horn Antenna	3115	9312-4192	Dec. 28, 2016	Dec. 27, 2017
Max Full. Turn Table & Tower	MF7802	MF780208103	NA	NA
Software	Radiated_V8.7.08	NA	NA	NA
SUHNER RF cable With 4dB PAD	SF106-18	Cable-CH7-01	Aug. 14, 2017	Aug. 13, 2018
SUHNER RF cable With 3/4dB PAD	SF102	Cable-CH7-3.6m	Aug. 14, 2017	Aug. 13, 2018
MICRO-TRONICS Notch filter	BRC50703-01	010	May 31, 2017	May 30, 2018
MICRO-TRONICS Band Pass Filter	BRM17690	005	May 31, 2017	May 30, 2018

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Chamber No. 7.
3. The Industry Canada Reference No. IC 7450E-7.
4. The VCCI Site Registration No. G-39
5. The FCC Designation Number is TW1078.
6. Tested Date: Aug. 19, 2017

7.3 Test Arrangement

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna can be varied from one meter to four meters, the height of adjustment depends on the EUT height and the antenna 3dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The spectrum analyzer system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection (PK) at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.



* :depends on the EUT height and the antenna 3dB beamwidth both.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

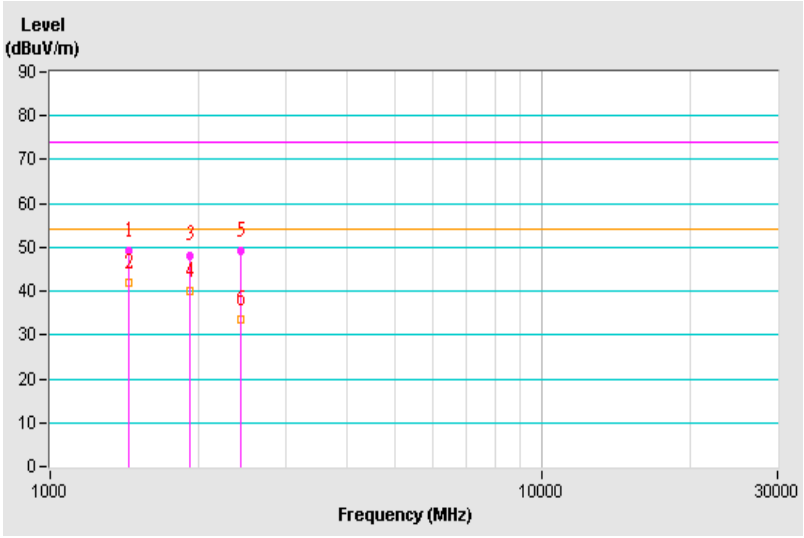
7.4 Test Results

Frequency Range	1GHz ~ 30GHz	Detector Function & Resolution Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power	55Vdc	Environmental Conditions	30℃, 58%RH
Tested by	Paul Chen		
Test Mode	Mode 5		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1439.97	49.26 PK	74.00	-24.74	1.89 H	224	50.63	-1.37
2	1439.97	41.97 AV	54.00	-12.03	1.89 H	224	43.34	-1.37
3	1919.99	48.20 PK	74.00	-25.80	1.06 H	224	47.86	0.34
4	1919.99	40.01 AV	54.00	-13.99	1.06 H	224	39.67	0.34
5	2437.61	49.18 PK	74.00	-24.82	1.12 H	52	47.68	1.50
6	2437.61	33.63 AV	54.00	-20.37	1.12 H	52	32.13	1.50

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

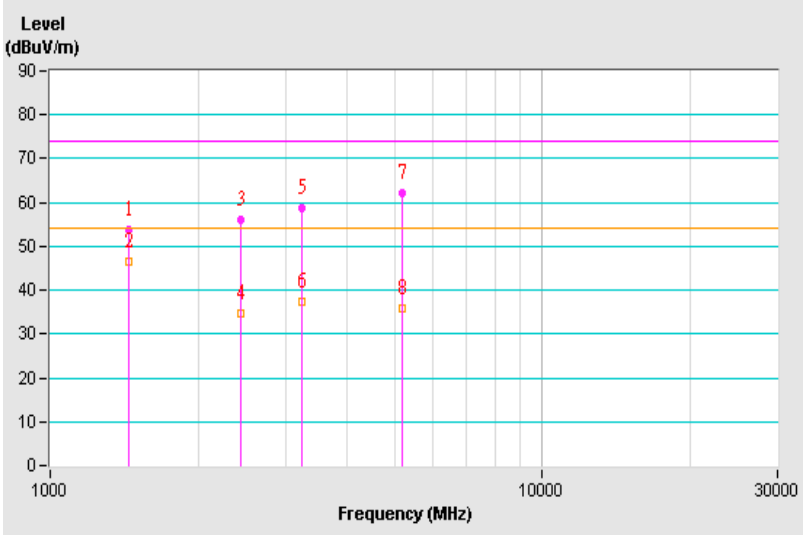


Frequency Range	1GHz ~ 30GHz	**Detector Function & Resolution Bandwidth**	Peak (PK) / Average (AV), 1MHz
Input Power	55Vdc	**Environmental Conditions**	30℃, 58%RH
Tested by	Paul Chen		
Test Mode	Mode 5		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	1440.21	53.72 PK	74.00	-20.28	1.72 V	0	55.10	-1.38
2	**1440.21**	**46.61 AV**	**54.00**	**-7.39**	**1.72 V**	**0**	**47.99**	**-1.38**
3	2436.04	55.88 PK	74.00	-18.12	1.52 V	136	54.40	1.48
4	2436.04	34.62 AV	54.00	-19.38	1.52 V	136	33.14	1.48
5	3249.39	58.85 PK	74.00	-15.15	1.37 V	278	54.28	4.57
6	3249.39	37.29 AV	54.00	-16.71	1.37 V	278	32.72	4.57
7	5174.49	61.98 PK	74.00	-12.02	1.61 V	101	53.67	8.31
8	5174.49	35.90 AV	54.00	-18.10	1.61 V	101	27.59	8.31

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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